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Original article

Inefficacy of Kinesio-Taping® on early postoperative pain after ACL reconstruction: Prospective comparative study



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ABSTRACT

Introduction: Kinesio-Taping® (K-Tape) is used in sports traumatology with the aim of reducing pain and improving blood and lymph circulation. The main objective of the present study was to assess the efficacy of K-Tape on early postoperative pain after anterior cruciate ligament (ACL) reconstruction. The study hypothesis was that K-Tape significantly decreases pain.

Method: A prospective non-randomized comparative study was conducted in 2013–2014 and included all patients who underwent primary ACL reconstruction by hamstring graft. Analgesia was standardized. Two groups, “K-Tape” and “controls”, were formed according to the days on which the study physiotherapist was present. The K-Tape compression/decompression assembly was applied immediately postoperatively and maintained for 3 days. Patients filled out online questionnaires. The main assessment criterion was mean postoperative pain (D0–D3) on a 0-to-10 scale. Secondary criteria were analgesia intake on the three WHO levels, awakening during the night of D0 due to pain, signs of postoperative discomfort, and patient satisfaction.

Results: Sixty patients (30 per group) were included, 57 of whom could be assessed: 28 K-Tape, 29 controls; 44 male, 13 female; mean age, 30.9 ± 8.9 years. At inclusion, the two groups were comparable. There was no significant difference in mean (D0–D3) knee pain intensity: 3.8 ± 2.2 for K-Tape, and 3.9 ± 2 for controls ($P=0.93$). Analysis of variance (ANOVA) found no significant intergroup difference in evolution of pain ($P=0.34$). There were no other significant differences on the other assessment criteria.

Conclusion: K-Tape showed no efficacy on early postoperative pain following ACL reconstruction.

Level of evidence: III; prospective non-randomized comparative study.

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1. Introduction

In 2014 in France, 43,792 arthroscopic cruciate ligament procedures (Diagnosis-Related Group 08C34) were performed [1]. Day surgery has recently been developed in this context in France, encouraged by the health administration [2]. Planning for and optimization of postoperative pain control increases patient satisfaction, facilitates early mobilization and allows same-day discharge home [3,4].

Knee surgery causes pain, which may be poorly controlled by standard analgesia. Some physicians have assessed alternative techniques. Acupression proved effective versus placebo in pain control after day knee surgery [5], and cryotherapy with dynamic

intermittent versus static permanent compression reduced analgesic intake after knee ligament reconstruction [6].

Kinesio-Taping® (K-Tape) is a therapeutic contention method developed by a Japanese physician in 1973 which is very popular with athletes. It is intended to prolong the impact of physiotherapy by applying fringed strips to create areas of compression and decompression. Efficacy on lower-limb drainage was demonstrated in animals [7] and patients managed by the Ilizarov technique [8], and in the forearm in patients with lymphedema after breast cancer surgery [9]. A recent meta-analysis found K-Tape to be significantly more effective on chronic musculoskeletal pain of more than 4 weeks' duration than was standard minimalist treatment, although less than conventional analgesia [10]. A randomized comparative study of total knee replacement found significantly better pain control with K-Tape from postoperative week 2 to end of physiotherapy [11].

To the best of our knowledge, K-Tape has not been studied in anterior cruciate ligament (ACL) reconstruction. The principal objective of the present study was therefore to assess efficacy

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on early postoperative pain following ACL reconstruction, on the hypothesis of significant alleviation.

2. Material and methods

A prospective non-randomized comparative study was conducted in 2013–14. Review Board approval (CPP IDF VI, La Pitié Salpêtrière Hospital, Paris, France) was secured for a non-interventional study.

2.1. Inclusion criteria

The study included a continuous series of patients undergoing primary ACL reconstruction by hamstring graft, performed by 3 senior surgeons, with conventional (non-daycare) admission. Exclusion criteria were multi-ligament involvement, body-mass index > 29, cardiovascular history, day surgery management, and patient's refusal. Two groups were formed, "K-Tape" and "control" (without contention) according to the days on which the physiotherapist was present in the operative room.

2.2. Anesthesia and analgesia protocols

Both groups received the department's usual anesthesia-analgesia protocol. Surgery was performed under general or spinal anesthesia, depending on the patient's and/or anesthetist's preferences. Ultrasound-guided crural block comprising 20 ml 0.475% ropivacaine was available in the induction room in either case. Prophylactic antibiotherapy was systematic.

Postoperative analgesia comprised i.v. paracetamol 1 g and naproxen 100 mg when non-steroidal anti-inflammatory drugs were not contraindicated, with or without associated tramadol 50 mg at 300 mg/day, followed by standard-dose oral relay. Morphine titration was initiated in the surveillance room in case of pain exceeding 5 on a 10-point visual analog scale, with anti-emetics (dexamethasone or ondansetron) in case of nausea or vomiting. During hospital stay, morphine was also available on demand.

At discharge, analgesia was systematically prescribed, with paracetamol associated to naproxen and an anti-gastric-secretion drug. In case of residual pain, the paracetamol tablet could be replaced by tramadol–paracetamol 37.5 mg/325 mg or paracetamol–codeine 500 mg/30 mg.

2.3. Application of K-Tape

A single specifically trained physiotherapist applied K-Tape, in the operative room after surgery. The blue cotton strips were cut into 5 bands, with edges rounded to prevent them coming unstuck. A fan-strip assembly (Fig. 1) was applied with the knee in 90° flexion, above the patella and at the gracilis and semitendinosus tendon donor site. 0–15% tension was exerted on application and checked by measuring the strip before and after application. The K-Tape was maintained for 3 days then removed by the patient following the physiotherapist's instructions. A single application was made in the K-Tape group.

2.4. Assessment criteria

The main assessment criterion was mean knee pain intensity from D0 (evening and night) to D3 on a VAS ranging from 0 (no pain) to 10 (worst imaginable pain).

Secondary assessment criteria were comprised of:

- daily pain intensity from D0 to D3;
- analgesia intake (WHO levels 1–3) from recovery room to D3;

Table 1
Baseline demographic data.

Preoperative variables	K-Tape group (N = 28)	Control group (N = 29)	P
Gender	7 F/21 M	6 F/23 M	0.69
Age (years)	29.2 ± 8.6	32.6 ± 9.1	0.14
BMI	23.8 ± 2.6	24.5 ± 3.1	0.37
Sports level	Professional 2 (7.1%) Competition 11 (39.3%) Regular leisure 15 (53.6%) Occasional leisure 0 No sport 0	Professional 0 (0%) Competition 16 (55.2%) Regular leisure 11 (37.9%) Occasional leisure 2 (6.9%) No sport 0	0.14
Subjective IKDC score	61.4 ± 12.8	58.7 ± 11	0.4
Objective IKDC score	A 0 B 0 C 21 (75%) D 7 (25%)	A 0 (0%) B 6 (20.7%) C 16 (55.2%) D 7 (24.1%)	0.1
Differential laxity on GNRB ^a 200 N (mm) [12]	4.3 ± 2.2	4.2 ± 2.2	0.91

BMI: Body-mass index; IKDC: International Knee Documentation Committee. Results expressed as mean ± standard deviation, and percentage.

^a GeNouROB laximeter.

- awakening due to pain during the night of D0;
- signs of postoperative discomfort (nausea and vomiting, dizziness, malaise, anxiety, stomach pain) from D0 to D3;
- allergic reaction to K-Tape;
- overall patient satisfaction.

Self-assessment used WebSurvey.fr[®] software following an email on D4 with a link to the online questionnaire.

2.5. Statistical analysis

Statistical analysis used STATA.10 software. Calculation of power indicated two groups of 22 patients to detect a 10% difference with 10% standard deviation, alpha risk of 0.05 and 0.90 power. Allowing for 10% incomplete files, it was decided to include at least 24 patients per group. Normal distribution was checked on Shapiro-Wilk test and homogeneity of variance on Bartlett test. Quantitative variables were analyzed on Student test and qualitative variables on Chi². Analysis of variance (ANOVA) was performed for multiple comparison of means, with Bonferroni correction.

3. Results

3.1. Description of patients

Sixty patients were included: 30 per group. Three (2 in the K-Tape group, 1 control) failed to provide postoperative data; 57/60

Table 2
Surgery data.

Surgical variables	K-Tape group (N = 28)	Control group (N = 29)	P
Spinal anesthesia	27 (96.4%)	22 (75.9%)	0.02
Associated crural block	15 (53.6%)	15 (51.7%)	0.88
Tourniquet time (minutes)	41.8 ± 5.9	43.9 ± 9.5	0.49
Cartilage lesions	2 (7.1%)	11 (37.9%)	0.006
Cartilage lesions treated	0	2 (6.9%)	0.48
Medial meniscus lesions	7 (25%)	10 (34.5%)	0.43
Medial meniscus lesions treated	5 (17.8%)	7 (24.1%)	0.11
Lateral meniscus lesions	6 (21.4%)	10 (34.5%)	0.27
Lateral meniscus lesions treated	4 (14.3%)	7 (24.1%)	0.77
Hospital stay (days)	2.7 ± 1.4	2.5 ± 1.2	0.64



Fig. 1. Application of colored elastic adhesive bands, (a) frontal suprapatellar, (b) at tendon graft harvesting site, and (c) lateral.

patients (95%) were analyzed (Fig. 2): 28 in the K-Tape group and 29 controls; 44 male, 13 female; mean age, 30.9 ± 8.9 years. The groups were comparable on baseline data (Table 1).

Surgically (Table 2), K-Tape patients were significantly more often operated on under spinal anesthesia. The control group showed significantly more cartilage lesions, mainly ICRS (International Cartilage Repair Society) type I or II; only 2 were treated by microfracture for type III lesions. There was no intergroup difference for presence or treatment of meniscal lesions. Partial meniscectomy was performed in 16 patients (9 medial and 7 lateral menisci) and repair in 7 (3 medial and 4 lateral menisci).

Mean hospital stay was 2.6 ± 1.3 days overall, without significant intergroup difference (Table 2). There were no complications or revision surgeries in the first postoperative week.

3.2. Main assessment criterion

There was no significant intergroup difference for mean D0–D3 knee pain intensity: VAS 3.8 ± 2.2 for K-Tape and 3.9 ± 2 for controls ($P=0.93$).

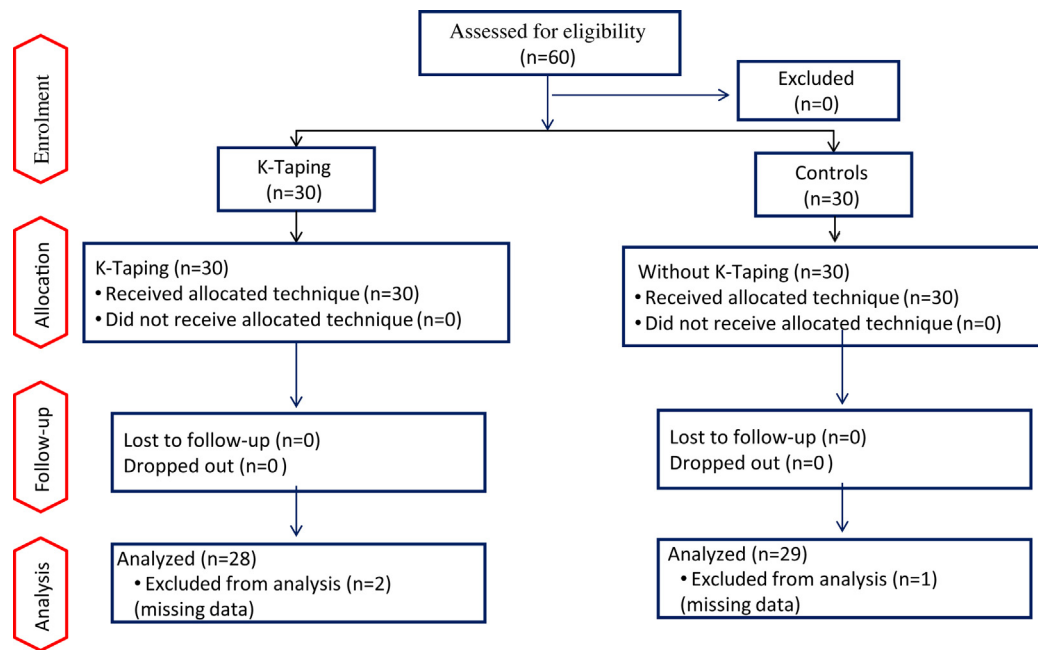


Fig. 2. Inclusion flowchart.

3.3. Secondary assessment criteria

ANOVA found no significant intergroup difference in evolution of pain ($P=0.34$) (Fig. 3).

Level 1, 2 and 3 analgesia intakes were comparable between groups from recovery room to D3. There was no significant intergroup difference in awakening due to pain in the night of D0 (13/28 vs. 18/29; $P=0.24$) or onset of symptoms of postoperative discomfort. All K-Tape patients (100%) were satisfied or very satisfied, as were 27/29 (93.1%) of controls; 2/29 (6.9%) control-group patients were moderately satisfied ($P=0.33$).

K-Tape patients showed no allergic reaction.

4. Discussion

In the present prospective comparative superiority study, K-Tape associated to standard analgesics was not more effective against early postoperative pain following ACL reconstruction than analgesia alone. Analgesia intake was comparable between groups.

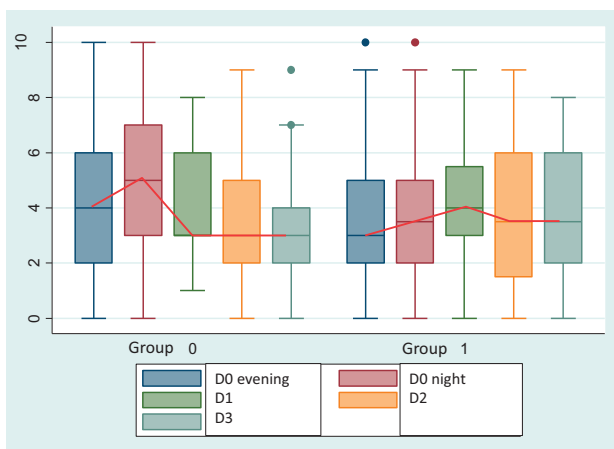


Fig. 3. Evolution of pain, night of D0 to D3. (Group 1 = K-Tape; Group 0 = Control).

The main reports show discordant findings. Several systematic reviews have been published. Morris et al. [13], in 2013, reviewed 8 randomized studies, including 6 in musculoskeletal disease, and found no proof of efficacy for K-Tape. Parreira et al. [14], in 2014, reviewed 12 randomized studies in various pathologies: cervicalgia (3), chronic low back pain (2), patellofemoral pain (2), shoulder pain (2), anterior knee pain (1), plantar fasciitis (1) and other (1), and came to the same conclusion. Lim et al.'s meta-analysis [10], in 2015, included 17 randomized comparative studies; in patients with more than 4 weeks' chronic musculoskeletal pain: K-Tape provided significantly better alleviation than minimalist treatment (-0.36 ; 95% CI, -0.64 to -0.09 ; $P=0.009$) but not than well-conducted analgesia (-0.44 ; 95% CI, -1.69 to 0.82 ; $P=0.49$); there was no significant impact on disability. Recently, Cho et al. [15], in a randomized comparative study in osteoarthritis of the knee, reported that K-Tape application to the quadriceps with suitable tension effectively alleviated various types of pain and improved range of motion and proprioception. Oliveira et al. [16] published the only study focusing on ACL reconstruction, but without assessing early postoperative pain; their randomized comparative study versus placebo showed no change in quadriceps neuromuscular performance at 12 to 17 weeks. The present study found no difference in D0–D3 postoperative pain following ACL reconstruction in favor of K-Tape, with no complications. K-Tape showed no efficacy against acute pain, but can be to some extent effective against chronic pain, as reported by Lim et al. [10].

The only possible risk in using K-Tape might be allergic reaction. Compared to classical bandaging, K-Tape was significantly more comfortable and easier to use for patients with lymphedema following breast cancer surgery [8].

The main strong point of the present study lay in its prospective comparative design, with prior calculation of sample size to be able to assess superiority. A single, specifically trained physiotherapist applied the K-Tape, and pain was assessed by the patient at home.

There were also several limitations. Notably, there was no randomization, as the physiotherapist was not present in the operative room every day. The study being non-interventional, the anesthesia-analgesia protocol was that usually implemented in the department, but was not designed specifically for the study.

K-Tape group patients were significantly more often operated on under spinal anesthesia, which may have led to assessment bias; however, according to Macdonald et al. [17], spinal anesthesia induces significantly less pain after ACL reconstruction than does general anesthesia. Cartilage lesions were significantly more frequent in control patients, but were mainly of ICRS types I or II: i.e., asymptomatic; there was no intergroup difference in the number of treated type III lesions. Finally, although the only risk of K-taping is allergic reaction, we chose not to conduct the study on a day-surgery basis. Evolution of edema could have been assessed by measuring knee circumference, but such was not the study objective. Longer-term assessment of pain could have been made.

5. Conclusion

K-Tape was not effective against early postoperative pain following ACL reconstruction. The study hypothesis is rejected.

Disclosure of interest

The authors declare that they have no competing interest.
The authors had no financial support from industry.

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